

Supporting Observers During Distributed Team Training - The Development Of A Mobile Evaluation System

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Summary

Distributed team training, often in joint settings, is becoming more and more important in the military training today. As the teams and training staff are not physically on the same location, special attention should be paid to performance measurement and feedback. The question is what should be measured in distributed training and how the training staff should be supported in doing this. This paper describes a mobile performance measurement and evaluation tool, specifically developed for distributed team training (MOPED). The MOPED tool helps the evaluator in observing team performance and in quickly generating, sending and receiving data to support his evaluation.

Introduction

Distributed team training, often in joint settings, is becoming more and more important in military training today. As the subteams and team members are not physically on the same location, performance measurement and providing feedback could be problematic. In order to give adequate feedback, it is essential that observers, who are distributed themselves as well, can quickly compare and integrate their observations. In this way, the time needed to prepare the after action review can be reduced to a minimum. The sooner the results of an exercise can be evaluated, the better it is. In a distributed context, there should be a relation between the performance of the own team and the higher level team in order to evaluate and improve the co-ordination and teamwork. Although systems for automated team performance measurement are becoming more available, it is still the human observer that is responsible for measuring team processes. However, measuring team processes is a difficult task. Besides, the risk of having several observers is multiple interpretations of the same observed behavior. Therefore, the issue is what should be measured in distributed training and how the training staff should be supported in doing this. This paper describes a mobile performance measurement and evaluation tool, specifically developed for distributed team training (Hiemstra, Van Berlo & Hoekstra, 2003). The tool helps the evaluator in observing team performance and in quickly generating, sending and receiving data to support the evaluation. In the next section, the characteristics of distributed teams will be described, as well as the performance measurement. Next, the methods and results of specifying the mobile tool will be illustrated. This is followed by a brief discussion about the first try-out of MOPED. Finally, some concluding remarks will be made.

1. Characteristics of distributed teams

A distributed team consists of several subteams and/or individuals working together on a joint mission, but who are not able to meet face-to-face because of differences in space and/or time. Distributed teams are characterized by the fact that they are geographically distributed, electronically linked, and functionally

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and/or culturally divers (Schraagen, 2001). In many respects, distributed teams are not different from teams conducting their tasks in a face-to-face environment. In both cases, the teams are serving the organization in achieving a certain, common, goal. However, installing distributed teams makes certain aspects of team performance more explicitly visible: who is responsible for what, how is the balance between self-direction and central management, how can teamwork be optimized between all subteams and individuals. Preparation before task performance as well as a common understanding on the various roles (convergence) seem to be crucial factors in the success of distributed teams (Rocco, 1998). The same holds true for the use of technological tools that links the team members. The diversity of teams can have a significant impact on the team's performance. Especially in the case of joint missions, involving teams with different organizational or national backgrounds, cultural differences can cause many problems. Multicultural teams should therefore explicitly formulate group norms and identify how these cultural differences could affect the cohesiveness and effectiveness of the team (Van Vliet, 2003).

Leadership in a distributed environment is critical in both the planning and the execution phase of the mission (Cook & Klumper, 1999). The emphasis should be on relationships within the distributed team, or with other words, on communication and interpersonal skills. The leader/commander should be open for advise, and he should have the competency to adopt other team members' perspectives (Cook & Klumper, 1999). This is difficult in a distributed environment because the context is incomplete. Team leaders should therefore explicitly indicate what issues they want to be informed about, when they want to be involved, and to what extent team members can make decisions on their own (Van Bree, Vlietman & Wierda, 2001).

A team can be effective on two levels: the task and the process level. On the task level, performance assessment is relatively easy because the task result can be measured objectively (e.g. completion of a mission, operating the equipment). This is more difficult for processes within a team or between teams. Previous research has shown that communication, information exchange, initiative/leadership and supporting behavior (Smith-Jentsch *et al.*, 1998) are important dimensions of team performance on the process level. Besides, Orasanu (1990) showed that better performing teams are better planning their actions. These aspects seem even more important for distributed teams, due to the lack of face-to-face contact. Singer et al (2001) investigated the differences between local and distributed teams. They found that in all cases the distributed teams did not outperform the local teams. Their explanation for this result was the lack of informal, and face-to-face, communication between the missions. Finally, Singer et al. (2001) stress the relevance of communication: because of the geographical distribution of team members, the interdependency increases, and therefore the need to communicate in order to achieve the shared and common goals.

2. Team performance measurement and feedback

To improve the training effectiveness, performance measurement and feedback should be conducted systematically and in a standardized manner across all distributed teams (Dwyer *et al.*, 1997; Fowlkes *et al.*, 1994). As the teams and training staff are not physically on the same location, special attention should be paid to performance measurement and feedback. Observations of the processes within the distributed team should be consistent among the various (distributed) observers in order to provide consistent feedback to the team members. The question is what should be measured in distributed training and how the training staff should be supported in doing this? Previous research has shown that communication, information exchange, team leadership and supporting behavior (Smith-Jentsch *et al.*, 1998) are important dimensions of team performance. These dimensions are even more important for distributed teams, due to the lack of face-to-face contact. In addition, preparation before task performance as well as a common understanding of the various roles (convergence) seem to be crucial factors in the success of distributed teams (Rocco, 1998).

Previous research on team performance measurement resulted in the Command and Control Process Measurement Tool (C2PMT; Van Berlo & Schraagen, 2000; Schraagen & Van Berlo, 2001). The C2PMT is a generic checklist comprising standards a command & control team should meet. Every standard is briefly

clarified and explained in order to ensure a uniform interpretation by the evaluators: it describes the contents and coverage of the standard and, if applicable, the relation with other standards. For every standard, performance indicators have been formulated giving concrete form to the standard enabling the evaluators to observe and interpret the team processes. These performance indicators are formulated concisely, and are easily scored in terms of whether the behavior was observed or not. The evaluator can explain and illustrate every observation: this contains both positive and negative examples being observed. Inclusion of these example behaviors is important for providing feedback in the final written report and for enhancing learning opportunities. The C2PMT was adjusted for distributed team training (C2PMT-Distributed). With this tool the evaluator can score targeted behaviors that are both important within the team and between the distributed teams. Based on previous research on the Mobile Aid for Training and Evaluation (Pruitt et al., 1997; Lyons & Allen, 2000), the C2PMT-D was implemented on a hand-held device. The functional specifications of this MOPED tool (MOBILE Performance measurement and Evaluation of Distributed team training) will be discussed in the next section.

3. Functional specifications of the MOPED tool

The MOPED tool comprises several generic categories on which the performance of a distributed team can be assessed. Every category is given concrete form by specific performance indicators. Completeness and usability of the performance indicators are balanced as well as possible. If possible, redundancies are avoided in order to prevent the same behavior being rated in several categories. In order to offer a tool that can easily be managed by observers, the total number of categories has been kept to a minimum. The categories are described below, illustrated with some performance indicators.

- a) Preparation: availability and quality of plans and checklists, concurrence of the plans and checklists between all distributed teams.
- b) Information flow within a team: modality and timing of information exchange.
- c) Information flow between teams: modality and timing of information exchange, informing the right persons/teams.
- d) Use of ICT systems: adequately using the communication devices, attunement of various ICT systems.
- e) Team decision making: indicating expectations by overall commander, stimulating participation by asking suggestions, clear and unambiguous decisions, stating the right priorities.
- f) Active monitoring of critical tasks: check deadlines, asking for clarifications.
- g) Interpersonal relations and mutual support: every team is actively involved, good atmosphere within the team, supporting each other without neglecting one's own task.
- h) Back up facilities: appointment of alternate commander, no interruption of the chain of command, back up of teams.

The MOPED-tool should not only facilitate the performance measurement, but the debriefing as well. In this respect it is important to know how the quality of the own team's performance relates to the performance of the other teams within the distributed context. However, especially during large-scale exercises with teams physically dispersed over a large area, the communication and information exchange between the also distributed observers is difficult. Therefore, the MOPED tool should facilitate the mutual data exchange between observers, and be able to receive and present these data in a format to be used during the debrief. Based on these demands, a pocket-PC has been chosen rather than a PDA or tablet-PC. The display of a PDA was considered to be too small, while a tablet-PC was regarded as too large to handle during field exercises. A pocket-PC can be easily carried, the display is large enough to get a clear overview, and a keyboard facilitates making notes/explanations. Figure 1 shows a picture of the MOPED tool. In the remainder of this section, the functionality of the MOPED tool is described. A more detailed discussion can be found elsewhere (Hiemstra, Van Berlo & Hoekstra, 2003).



Figure 1: The MOPED tool

The MOPED tool consists of six parts, displayed as buttons on the opening screen (see Figure 2). Selecting a button by tapping the stylus on the touch screen, activates the respective part of the program:

- New: the observer logs in, and indicates that a new session will start.
- Questionnaire: the checklist with performance indicators.
- Grading: overview of gradings.
- AAR: overview of observations indicated as relevant for the after action review.
- Send data: transmitting data to a central database.
- Results: observers' results of other teams, received and integrated by central database.

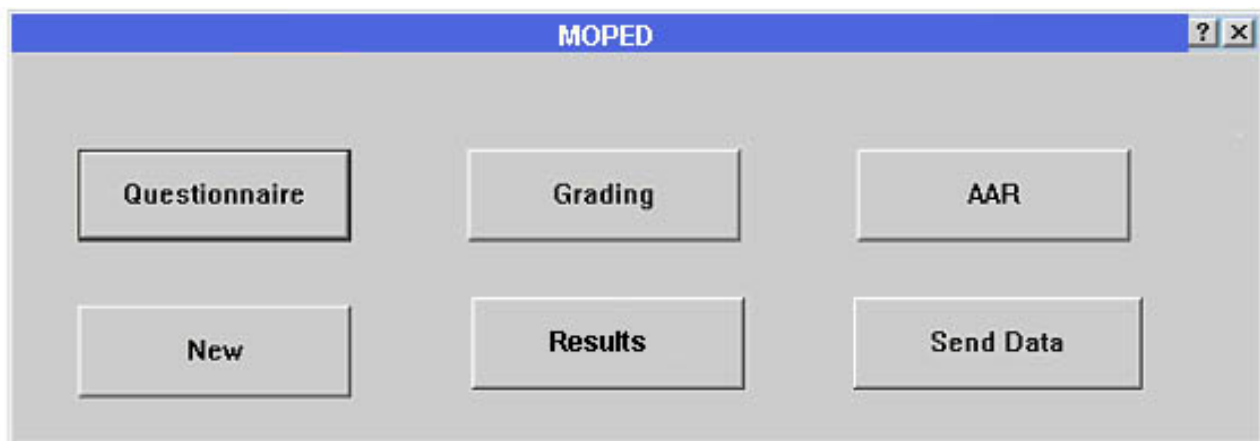
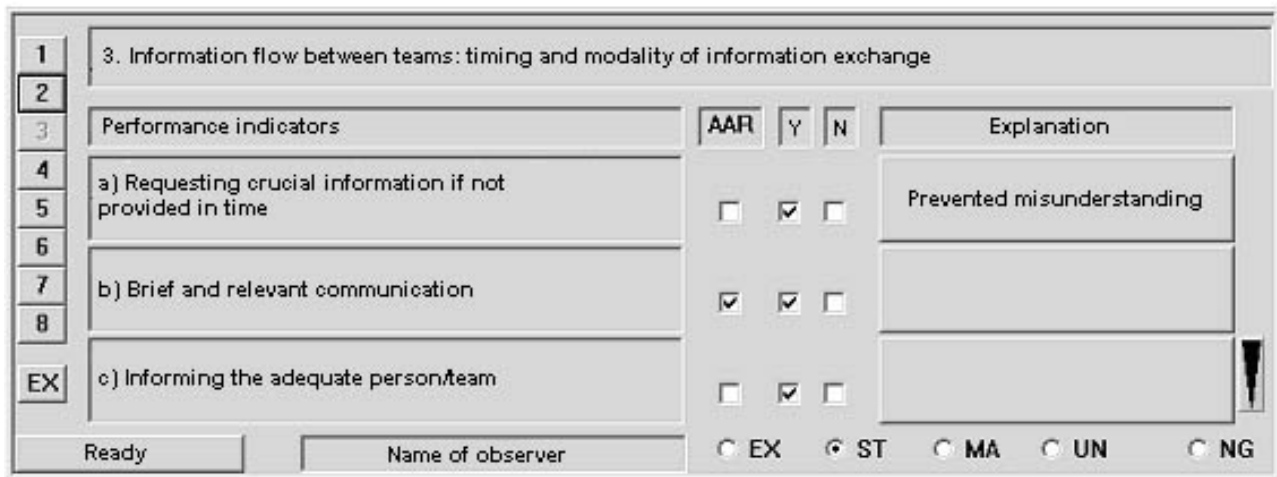


Figure 2: Opening screen of the MOPED tool

Figure 3 shows a screen dump of the C2PMT-D questionnaire. On the left-hand side, the buttons with numbers 1-8 direct the observer to the eight categories the C2PMT-D is comprised of. The category that is selected is depicted on the display. Every performance indicator can be checked as either observed (Yes) or not observed (No). In case the observer wants to include a performance indicator in the AAR, he checkmarks the AAR-button. On the right-hand side, the observer explains and illustrates the rating: this contains both positive and negative examples being observed. Tapping on an explanation-box presents a pop-up window enabling the observer to type in more elaborate text. Inclusion of these example behaviors is important for providing feedback in the final written report and for enhancing learning opportunities. Completely to the right are two arrows enabling the observer to scroll up and down through all performance indicators. After having filled out all performance indicators, an overall grading can be determined for the respective category (EX: excellent, ST: satisfactory, MA: marginal, UN: unsatisfactory, NG: not graded). During the course of an exercise, the observer can easily switch between all categories by tapping on the eight numbers. Tapping on the Ready-button leads the observer back to the opening screen.

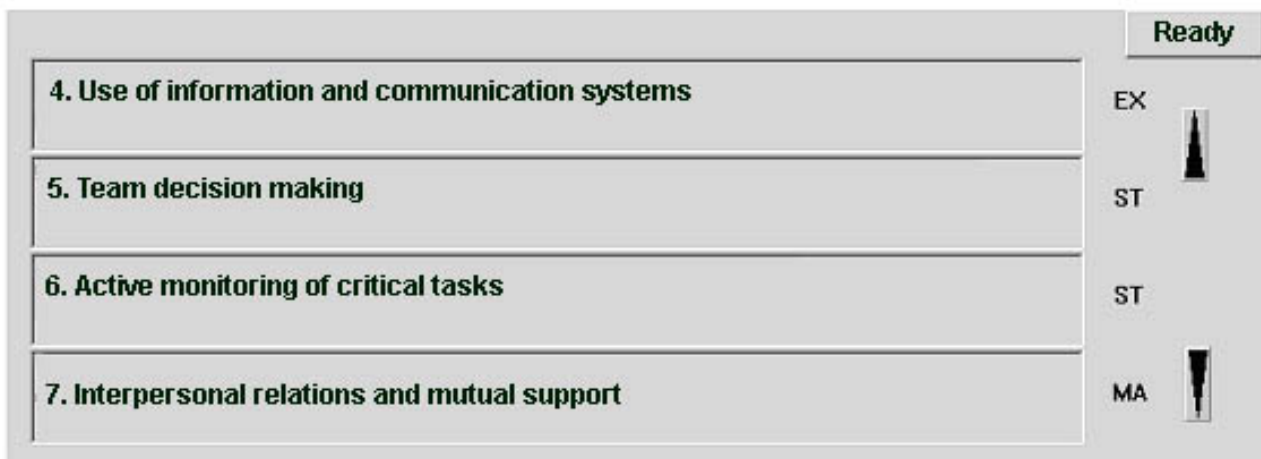


Performance indicators	AAR	Y	N	Explanation
a) Requesting crucial information if not provided in time	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Prevented misunderstanding
b) Brief and relevant communication	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
c) Informing the adequate person/team	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

Ready Name of observer ☐ EX ☒ ST ☐ MA ☐ UN ☐ NG

Figure 3: The C2PMT-D questionnaire

All checkmarks and explanations made by the observer are automatically linked to the other parts of MOPED. The overall gradings are linked to the 'Grading' overview. This overview depicts every category and its overall grading, providing for a concise summary of the team's performance (see Figure 4).



Category	Grade
4. Use of information and communication systems	EX
5. Team decision making	ST
6. Active monitoring of critical tasks	ST
7. Interpersonal relations and mutual support	MA

Ready

Figure 4: The Grading overview

After an exercise, the observer can send his observational data to the central database ('Send data'). In this central database, all observational data of all distributed observers are gathered and integrated. Only results that are explicitly related to the performance of the distributed team and not a local team (inter vs. intra) are sent back to the observers in the field. Figure 5 shows a screen dump of the 'Results'. The numbers behind every performance indicator show how many observers scored 'Yes' or 'No'. The box behind it show the remarks and explanations made by every other observer. Tapping on it will enlarge this box.

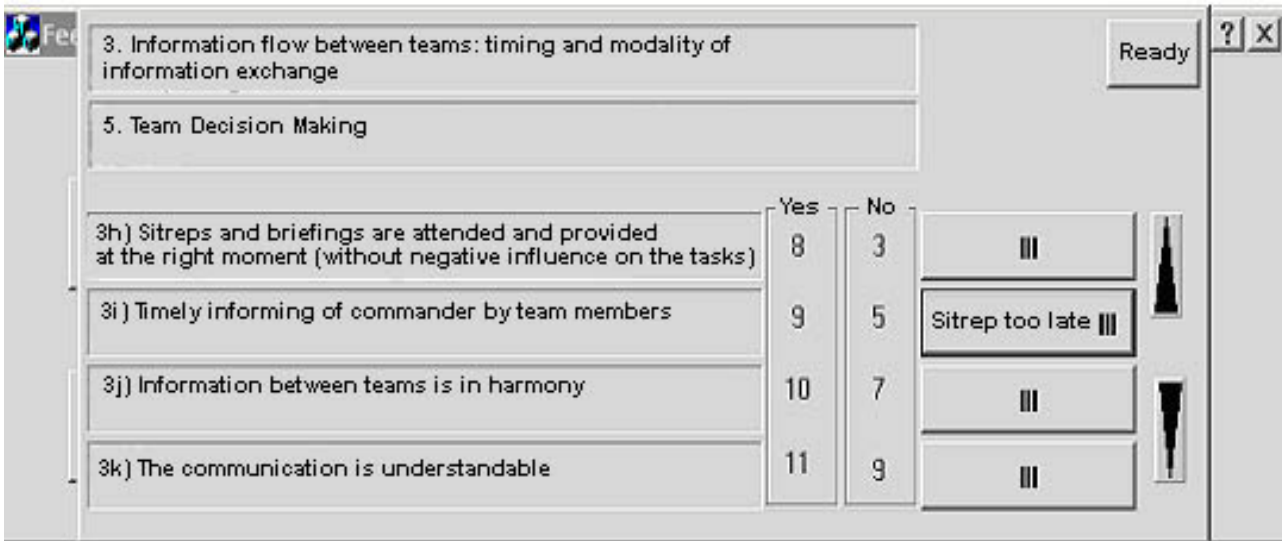


Figure 5: The Results overview

In case the observer wants to include a performance indicator in the after action review, he checkmarks the AAR-button behind it. An overview of all these performance indicators is provided in the AAR-part of MOPED. This overview helps the observer in preparing and conducting the after action review. Figure 6 shows a screen dump of the AAR-overview.



Figure 6: The AAR overview

5. Try-out

A try-out has been conducted at the Operational School of the Royal Netherlands Navy for a period of two weeks (for a more detailed discussion, see Van Rijk, Hiemstra & Hoekstra, 2003). The team was the command central team responsible for the defense of a frigate. This team is divided into two teams who have to work together, but have their own tasks as well: one covering the Anti Air Warfare domain, and the other the domain of Anti Surface/Subsurface Warfare. Although the teams share the same command central on board, during off shore training exercises they use two separate simulators. Simultaneously training the distributed teams using a shared virtual environment and the same training scenario provided the opportunity to conduct a small scale try-out of the MOPED-tool as well as the C2PMT-D questionnaire. For this purpose, the generic version of the C2PMT-D has been adapted to this specific domain and this specific Navy command team. Further, a less dichotomous way of scoring has been implemented: in the try-out version, performance indicators can be scored on various scales rather than only 'yes' or 'no'. Besides on the

pocket-PC, MOPED was also be installed on a tablet-PC. In this way, the advantages and disadvantages of the man machine interface and the usability of the hand held computers could be evaluated. Four trainers tested MOPED during 2 weeks in 32 training sessions. Data were collected with a questionnaire, observations and interviews.

It was the first try-out of MOPED, so it was inevitable to have several disadvantages. The most important one was that the participants suggested improving the debrief facility. MOPED offers a fixed sequence of items based on the ranking in the questionnaire. The participants, however, wanted to sequence and cluster the items themselves. With respect to the Pocket PC, it was difficult to keep an overview. A disadvantage of the Tablet PC was the weight and the heating up after a while.

One of the advantages was that MOPED enables a quick data exchange between the observers. Further, the team's result was immediately computed, and MOPED supported a quick arrangement of items for the debriefing. Further, the tool was easy to use, with no flipping around of paper pages. With respect to the C2PMT-D items, the results were not clearly interpretable: most items were perceived as valuable, but during several training sessions the performance measurement appeared to focus only on the commanders of the two teams, meaning that not all items of our questionnaire were actually filled out.

6. Conclusion

The C2PMT-D is a generic method that can improve the quality of the observations made during distributed mission training because of the standardized format in which targeted behaviors are scored. Implementation of this method in the MOPED tool supports the observers in quickly generating and processing performance data and organizing the after action review. Based on the experiences with the C2PMT (Van Berlo & Schraagen, 2000; Van den Bosch & Van Berlo, 2002), applying the MOPED tool will have the following advantages:

- A clear insight into the command and control process of distributed teams.
- An objective assessment of the distributed team's command and control process based on the performance indicators.
- Support of relatively inexperienced observers.
- The results of an exercise are easier to interpret.
- The results of various exercises are mutually comparable.
- The lessons learned can be determined more easily.
- Follow-on actions can be determined in a more structured way.

The MOPED tool provides the means for gathering facts and data concerning the quality of command and control processes, and therefore has the potential to determine follow-on actions not exclusively related to training issues, but also to the real-life (quality) management of organizational processes. Possible follow-on actions could relate to, for instance, the quality and availability of checklists, the attunement of various ICT systems, and the security awareness of the personnel.

7. Further Research

Further research will be conducted on the development and validation of the various parts of the MOPED tool. At the moment, the MOPED tool is a prototype with a generic version of the C2PMT-D. Try-outs during several exercises, combined with experiments, are required to improve the quality and usability of both the method and the tool. This will bring us to a better understanding of performance measurement and feedback in distributed team training, and a validation of the method.

Further, we want to improve the support for the AAR. In the current version of the MOPED tool, the organization of the after action review is supported by the 'Grading' and the 'Results' overviews, showing the results of the team's performance in isolation and in the context of the distributed team. This covers the

content of the AAR, but not the process of the debriefing itself. Further research will be conducted on methods to facilitate and guide an after action review of a distributed team, and how these methods could be supported by the MOPED tool.

Finally, integrating the MOPED tool into existing technological frameworks is another possibility. One such framework is MIND, developed by the Swedish Defence Research Agency (FOI). The MIND visualization framework has been developed based on the need to handle large amounts of data pertaining to diverse aspects of distributed rescue operations (Morin, 2002). MIND uses data collected in the real environment, regardless if it is a live operation or a training exercise, to construct a time-synchronized, discrete-event representation of the course of events of the operation. The resulting model is a multimedia representation of the distributed tactical operation that can be presented in a visualization tool that supports time-based navigation and animation using multiple views. MIND has been used for supporting after-action reviews in different settings (Crissey, Morin & Jenvall, 2001; Thorstensson et al., 2001). TNO Human Factors and FOI are currently in the process of combining their expertise of human factors knowledge, computer science and training experience. Further research could aim at the integration of the MIND system and the MOPED tool in order to enhance the quality and speed of the data collection and analysis (Van Berlo et al., 2003). This should result in achieving the optimal combination of automated performance measurement and feedback and human observations.

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